NOT
MEASUREMENT
SENSITIVE

MIL-HDBK-1798A
24 September 2001

SUPERSEDING
MIL-HDBK-1798 (USAF)
19 December 1997

DEPARTMENT OF DEFENSE
HANDBOOK

MECHANICAL EQUIPMENT AND SUBSYSTEMS INTEGRITY PROGRAM

This handbook is for guidance only.

Do not cite this document as a requirement.

AMSC N/A AREA SESS

FOREWORD

1. This handbook is approved for use by the Department of the Air Force and is available for use by all Departments and Agencies of the Department of Defense.

2. This handbook is for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

3. This handbook establishes programmatic tasks for the development, acquisition, modification, operation, and sustainment of the mechanical elements of airborne, support, and training systems. The Mechanical Equipment and Subsystems Integrity Program (MECSIP) consists of a series of disciplined, time-phased actions which, when applied in accordance with this handbook, will help ensure the continued operational safety, suitability, and effectiveness of the mechanical systems throughout all phases of the weapon system life.

4. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASC/ENOI, 2530 LOOP ROAD WEST, WRIGHT-PATTERSON AFB OH 45433-7101; by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or a letter.

CONTENTS

1. SCOPE

1.1 Purpose. The purpose of this handbook is to describe the general process to achieve and maintain the physical and functional integrity of the mechanical elements of airborne, support, and training systems. The goal of the program is to ensure the operational safety, suitability, and effectiveness (OSS&E) of a weapon system, while reducing total operating cost. The process described herein is in direct support of the OSS&E Air Force Policy Directive 63-12 and the Air Force Instruction 63-1201 requirements to establish a disciplined engineering process that will ensure the physical and functional integrity of the system being procured. This handbook allows the process to be tailored in a competitive environment to meet specific equipment, subsystem, and/or system requirements. The Mechanical Equipment and Subsystems Integrity Program (MECSIP) is implemented in the planning process and continued until retirement of the system. This handbook should be tailored for each program in accordance with specific program strategy.

The process described herein is a “cradle-to-grave” process that is equally applicable to the design phase as it is to the sustainment phase. It applies to new development, modifications, upgrades, and sustainment. It applies equally to both development and non-development items, including commercial off-the-shelf. For development items, the purpose of this process is to establish and sustain a design that meets the service life, mission, usage, and environmental requirements. For non-development items, the emphasis is on definition of the capabilities of the item when subjected to the intended service life, mission, usage and environments. If shortfalls are identified in the existing capabilities of a non-development item, the System Program Office then has the necessary information to initiate the appropriate trades relative to the cost of the design change versus required performance, maintenance actions, total operating cost, impact on mission, etc.

1.2 Use. This handbook cannot be used for contractual purposes until it is tailored with specific supplemental information pertinent to the equipment or system being procured. The information from this handbook is intended for inclusion in the Request for Proposal (RFP) and contract Statement of Work (SOW). Once the system is fielded, the MECSIP manager should tailor an appropriate integrity program based on the information contained in this handbook and the integrity program established during the development phase. This handbook is for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

1.2.1 Structure. The supplemental information required is identified within the text of this handbook.

1.3 Program approach. The MECSIP is an organized and disciplined engineering and management process to ensure the integrity (e.g.; durability, safety, reliability, and supportability) of mechanical systems and equipment is achieved in development and maintained throughout the system’s operational service life. The process consists of phased tasks which focus on the following:

a. application of a disciplined system engineering approach to design and development which emphasizes the determination and understanding of failure modes and consequences on operational performance;

b. comprehension of total system operational and support needs and the development of the resulting mechanical system and equipment requirements;

c. emphasis on realistic integrity requirements such as operational service life, usage, and environments (including maintenance and support) as the basis for design and qualification;

d. early trade studies to evaluate operation and support factors in concert with cost, weight, and performance; and to ensure compatibility between design solutions, support equipment needs, and maintenance concepts;

e. a disciplined design and development process scheduled to ensure early evaluation of material characteristics, manufacturing processes, and equipment response to design usage;

f. an integrated analysis and ground test program to evaluate design performance and integrity characteristics;

g. tests and demonstrations scheduled to ensure test findings are incorporated into the design in advance of major economic and/or production commitments;

h. controls on manufacturing as required to ensure quality and integrity of hardware throughout production;

i. development of force management requirements (including maintenance and inspection) based on the results of the development process;

j. a program to measure actual usage and environment for the fielded equipment; and

k. a tracking system for components and systems.

1.4 Program overview. The effectiveness of any military force depends on the mission effectiveness and operational readiness of its weapon systems. A major factor which affects readiness and mission reliability is the integrity (including durability, safety, reliability, and supportability) of the individual systems and equipment which comprise the total weapon system. The U.S. Air Force has adopted the "Weapon System Integrity Process" as the key vehicle to develop, achieve, and maintain required performance economically for the various elements of the weapon system to enhance equipment effectiveness and meet operational needs. The integrity process has been adopted from the highly successful Aircraft Structural Integrity Program (ASIP), first employed in the late 1950's. This process captures the generic features of ASIP and builds upon the evolution and experiences gained over the last five decades.

The MECSIP description in this handbook is intended to illustrate the various tasks required to achieve specific performance and supportability requirements. Although the MECSIP is generally applied at the system level, it can and will be tailored for single hardware components. The process described herein must also be tailored and applied to evaluate the capability of existing systems and equipment, including off-the-shelf components.

The MECSIP process consists of a strategy described in the master plan that provides mechanical systems and associated equipment with the required integrity throughout the operational service life.

1.5 Applicability. This handbook applies to all systems, equipment, and components whose primary function is mechanical in nature. Examples include these systems: arresting gear, auxiliary power, crew escape, electromechanical elements of electrical power, electrical wiring, environmental control, fire protection, flight control, fuel, ground support, hydraulic, landing gear, life support, pneumatic, training, and maintenance.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed below are not necessarily all the documents referenced herein, but are those necessary to understand fully the information provided by this handbook.

2.2 Government documents

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the latest issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto.

Department of Defense

Specifications

Standards

Handbooks

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094; [215] 697-2179; http://assist.daps.mil.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein.

Air Force Policy Directive 63-12	Assurance of Operational Safety, Suitability, & Effectiveness
Air Force Instruction 63-1201	Assurance of Operational Safety, Suitability, & Effectiveness

(U.S. Air Force Directives and Instructions are available from the U.S. Air Force Publications Distribution Center, 2800 Eastern Blvd., Baltimore MD 21220-2898; [410] 687-3330; http://afpubs.hq.af.mil.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

Definitions applicable to this handbook are contained in the following subparagraphs.

3.1 Analysis. Analysis is the diagnostic effort that illustrates contractual requirements have been achieved. This effort may include solution of equations, performance of simulations, evaluation and interpretation of charts and reduced data, and comparisons of analytical predictions versus test data. The normal reduction of data generated during ground and flight tests is not included. This effort is usually performed by the contractor.

3.2 Damage tolerance. Damage tolerance is the ability of critical systems or equipment to resist failure or loss of function due to the presence of flaws, cracks, damage, etc., for a specified period of unimpaired service usage.

3.3 Demonstration. Demonstration is an engineering effort performed to show contractual requirements have been met. Compliance or noncompliance is determined by observation only. Fit and function checks may be accomplished as demonstrations. This effort is usually performed by the contractor.

3.4 Durability. Durability is the ability of the system or component to resist deterioration, wear, cracking, corrosion, thermal degradation, etc., for a specified period of time.

3.5 Durability-critical component. A durability-critical component is a component whose failure may entail costly maintenance and/or part repair and replacement which, if not performed, would significantly degrade performance and operational readiness. These components are not safety- or mission-critical, but may have a major economic impact on the system.

3.6 Durability-noncritical component. A durability-noncritical component is one whose failure would result in a minor economic impact on the system but would require maintenance and/or repair or replacement to ensure continued performance. These components do not usually require special attention during production and could be maintained on either a corrective- or preventative-maintenance basis.

3.7 Economic life. Economic life is the operational service period during which it is judged to be more economically advantageous to repair than replace a component, based on an evaluation of data developed during system development.

3.8 Inspection. Inspection is the visual evaluation of physical items, documentation, drawings, etc., for conformance with contractual requirements. This effort is usually performed by the contractor but may be performed by cognizant U.S. Air Force personnel, contingent upon contractual requirements.

3.9 Integrity. Integrity is comprised of the essential characteristics of systems and equipment which allow specified performance, reliability, and supportability to be achieved under specified operational conditions over a defined service lifetime.

3.10 Maintenance-free operating period. This phase is that segment of the required operational service life during which no preventative maintenance is required to ensure performance and operational readiness. The results of durability testing and analysis are used to determine the maintenance-free operating period.

3.11 Mission-critical component. A mission-critical component is a component whose failure would: (a) prohibit the execution of a critical mission, (b) significantly reduce the operational mission capability, or (c) significantly increase the system vulnerability during a critical mission.

3.12 Other/expendable components. Other/expendable components includes all components of a system not classified as safety critical, mission critical, durability critical, or durability noncritical. The failure of these components could be handled during routine maintenance and would not impact the mission, safety, or operational readiness.

3.13 Required operational service life. The required operational service life is that operational life specified for the specific system, subsystem, or component—usually in terms of service or operation time.

3.14 Required operational service period. The required operational service period is a portion of the service time, and a portion of the required operational service life.

3.15 Safety-critical component. A safety-critical component is a component whose failure would cause loss of the air vehicle, injury to personnel, or extensive damage to critical equipment/structures which could adversely affect safety of flight or personnel.

3.16 Test. Test is an empirical effort performed to show that contractual requirements have been met. Documented procedures, instrumentation, and known environmental conditions are normally applicable. Compliance or noncompliance is determined by observation, where practical, and evaluation of collected data. Most ground and flight empirical efforts associated with this procurement and acquisition qualify as tests. This effort is usually performed by the contractor.

3.17 Usage. Usage is defined as the operational parameters critical to function, performance, and service-life of the system and equipment (e.g.; missions, duty cycles, loading, environments, etc.).

4. REQUIREMENTS

4.1 Mechanical Equipment and Subsystems Integrity Program (MECSIP). The overall MECSIP includes a program strategy master plan that defines the basic elements, tasks, subtasks, analyses, tests, and force management actions required to achieve and maintain product integrity throughout the operational service life.

The MECSIP program established and maintained in accordance with this handbook must be tailored to satisfy specific program strategies. Application of the MECSIP requires tailoring of the various tasks, subtasks, and elements contained herein. It is intended that a separate, tailored MECSIP will be developed for the various systems or equipment, and that it will be integrated into the overarching system acquisition plan. The MECSIP is most effective when applied early in the acquisition cycle, through implementation of the initial Task I elements described herein. Early implementation generally ensures system-level requirements are appropriately translated into requirements for individual system elements—including airborne, ground support, and training systems. Early implementation will also ensure important concept and performance trade studies are influenced. Table I summarizes the various MECSIP tasks described in this handbook.

TABLE I. Mechanical System Integrity Program life-cycle tasks.

TASK I	TASK II	TASK III	TASK IV	TASK V
Preliminary Planning	Design Information	Design Analyses and Development Tests	Component Development and Systems Functional Tests	Force Management
❑ Program Strategy ❑ Trade Studies ❑ Development of Requirements ❑ Preliminary Integrity Analysis	❑ MECSIP Master Plan ❑ Design Criteria ❑ Design Service Life/Design Usage ❑ Critical Parts Analyses and Classification ❑ Material and Process Selection and Characterization ❑ Product Integrity Control Plan ❑ Corrosion Prevention and Control	❑ Load Definition ❑ Design Stress/ Environment Spectra Development ❑ Performance and Function Sizing Analysis ❑ Thermal/ Environmental Analyses ❑ Stress/Strength Analyses ❑ Durability Analyses ❑ Damage Tolerance Analyses ❑ Vibration/ Dynamics/ Acoustic Analyses ❑ Material Characterization Tests ❑ Design Development Tests	❑ Functional Tests ❑ Strength Testing ❑ Durability Testing ❑ Vibration/ Dynamics/ Acoustics Tests ❑ Damage Tolerance Tests ❑ Thermal and Environmental Survey ❑ Maintainability/ Reparability Demonstrations ❑ Evaluation and Interpretation of Test Results ❑ Integrated Test Plan ❑ Final Integrity Analysis ❑ Maintenance Planning and Task Development	❑ Component Tracking/ Monitoring Program ❑ Preventative Maintenance Actions ❑ Monitoring of Repairs/Overhauls ❑ Inspection Criteria

4.1.1 Tailoring approach. The U.S. Air Force will establish the requirement to scope, tailor, and implement the MECSIP, in addition to other applicable integrity programs, early in the acquisition process. This information should be provided with the Instructions To the Offeror (ITO) as part of the RFP package. In the response to the RFP, the contractor must define his application strategy and delineate program objectives, schedules, milestones, tasking requirements, and other information that concerns the tailoring and application of the requirements of this handbook. Tailoring and application will be one of the MECSIP Task I elements, as described in 4.2. The purpose for developing a program strategy and tailoring approach is to ensure appropriate program management and planning attention is given to the implementation of the MECSIP. Especially important is the need to ensure system technical requirements and design criteria reflect overall operational needs, and that proper integration, plans, tasking, and scheduling are provided throughout the acquisition.

4.1.2 Implementing Statement of Work. The MECSIP procurement is normally accomplished through Statement of Work tasks. In accordance with procurement guidelines, a Statement of Work must be developed that covers the tailored tasks, subtasks, strategy, plans, and the effort to be accomplished.

4.2 (Task I) Preliminary planning. Task I is intended to be accomplished either in advance of, or at the beginning of the System Development and Demonstration phase (formerly known as the Engineering and Manufacturing Development phase). The purpose of Task I is to scope the tailoring, planning, and development strategy for applying the MECSIP. The tasks expected during this period for major weapon system procurements include the methods detailed in the subparagraphs which follow.

4.2.1 Program strategy. A MECSIP program strategy must be developed to establish definitive objectives early in the acquisition. The MECSIP strategy will support and be one of the elements of the overall acquisition strategy for the system. Areas such as materials, processes, manufacturing, testing, facilities, manpower, funds, and schedules are all involved in developing this strategy. Technology improvements and advancements necessary to achieve specific program objectives must be defined, quantified, scheduled, and evaluated for cost benefits. The strategy will become progressively definitive as the acquisition strategy matures, and as it becomes possible to develop and weigh alternative approaches to satisfy system needs. Simply stated, the strategy should address the "what", "how", "when", and "with what" aspects of applying the MECSIP to full acquisition and deployment of the systems and equipment.

4.2.2 Trade studies. As part of the early acquisition process, system engineering trade studies should be conducted at both the system- and component-level, as appropriate. The purpose of these trade studies is to examine alternative approaches which satisfy the system operational safety, suitability, and effectiveness. Proper consideration must be given to supportability, reliability, maintainability, and cost, in addition to technical performance, when these trade studies are performed. The use of new computer programs and technologies for component tracking and monitoring should be included in the trade studies.

4.2.3 Development of requirements. Part of the early acquisition process should be devoted to the study and refinement of system-level requirements as they evolve from the consideration of operational needs, supportability goals, etc. As part of this refinement process, system requirements should be evaluated, particularly in conjunction with the early trade studies. The objective is to enter into system development with optimized and balanced design requirements.

4.2.4 Preliminary integrity analysis. The pre-development activity should define the risks of the candidate system concepts to achieve performance and integrity goals. This requires an understanding of the physical concepts and failure modes, and requires a limited database that defines the candidate materials, processes, and technologies. These analyses may be particularly important, since they typically support the early engineering trade studies. Preliminary analyses should include, but not be limited to, equipment sizing, estimates of component and system service life potential, failure modes analysis, classification of critical components, and identification of hidden failures.

4.3 (Task II) Design information. This task encompasses the efforts required to apply the existing technical database and operational criteria to the initial design, development, materials, processes, and production planning for each specific system or equipment application. The objective is to ensure the operational and support needs are met. Tasking is initiated as early as practical in the procurement. Several subtasks are iterated during the design development cycle and finalized later in the system development. Information in Task II is developed by the contractor based on instructions provided by the procuring activity in the ITO and supported by the results of Task I.

4.3.1 MECSIP master plan. A master plan will be developed to define and document the details for accomplishing all tasks and subtasks of the MECSIP. The plan will define overall strategy and the time-phased scheduling of the various integrity tasks for design, development, qualification, and force management of the specific system hardware. The plan will include discussions of unique features of the program, exceptions to this handbook, a complete discussion of each proposed task, rationale for each task and subtask, and an approach to address and resolve all problems anticipated in the execution of the plan. The development of the schedule must consider other program interfaces, impact of schedule delays (e.g., delay due to test failures), mechanisms for recovery, programming, and other potential problems areas.

The plan will include the time-phased scheduling and integration of system development tasks which support performance and integrity requirements for the equipment being acquired. The plan is intended to highlight programmatic issues, schedules, analyses, functional tests, development and verification tests, test data, evaluation criteria, contractor/vendor tasks, milestones, etc. The plan must identify approaches for the analyses and tests, including descriptions of proposed analytical and test methods, assumptions, data criteria, etc. The plan must include the design criteria to be used, the basis for criteria selection, and the relationship of criteria to overall system requirements.

The MECSIP master plan is a living document, updated periodically throughout the life of the system. The master plan must be developed by the contractor during system development and submitted in accordance with specific program requirements. While the specific content of the plan will not be contractual, the document will be subject to U.S. Air Force approval. It must organize the approach to include all elements of each specific system application. It must address contractor, subcontractor, and vendor equipment, as well as government-furnished equipment (GFE) and off-the-shelf (OTS) equipment. It will be the responsibility of the contractor to address GFE and OTS equipment through an assessment approach consistent with this handbook. The approach must ensure that system requirements are satisfied and that maintenance requirements can be defined and included in the overall force management plan.

It is the responsibility of the System Program Office to establish and maintain the master plan during the sustainment phase of the program. The plan should include the actions contained in Task V and should capture the knowledge and experience gained during the previous phases.

4.3.2 Design criteria. The contractor must translate the system requirements into specific design criteria to be used for material selection, equipment sizing, design, analysis, and test. The objective is to ensure criteria which reflect the planned usage of the systems are applied to the development and verification process so that specific performance, operational, and maintenance/support requirements can be met. The task of developing design criteria begins as early as practical in the development cycle. Specific criteria must be developed to support functional performance, durability, damage tolerance, strength, vibration/dynamic response, maintenance, integrity management, and other specified requirements.

4.3.3 Design service life/design usage. Design criteria will be derived to reflect required component/system service life and usage as contained in the individual system-level requirement documents. These criteria may reflect findings of system trade studies conducted early in the acquisition process (i.e., Task I). The operational service life requirements may be satisfied by a designed-in, maintenance-free operating period and scheduled preventative maintenance. In early trade studies, the contractor must evaluate the impact of maintenance-free versus scheduled maintenance operating periods on cost, weight, and performance. The studies must also consider the logistics and support requirements, the overall maintenance concept, and the implementation approach for component/system maintenance tracking. The tracking system must assist the MECSIP manager in performing the duties listed in Task V. The result of these trade studies will be used to define the design service life criteria for specific components as well as in-service maintenance required to achieve the specified total required operational service life. Establishment of designed-in scheduled preventative maintenance must be consistent with the operational, logistics, and support requirements. The approach to definition and development of the design service life and design usage will be included in the MECSIP master plan.

4.3.4 Critical parts analysis and classification. As early as practical, the contractor must establish an approach to identify and classify critical hardware components for the specific system. Critical parts must be identified for application of specific criteria (e.g., durability and damage tolerance) related to materials, processing, manufacturing, maintenance tracking, etc. As a minimum, the following five categories (defined in section 3) will be used:

a. Safety-critical components

b. Mission-critical components

c. Durability-critical components

d. Durability-noncritical components

e. Other/expendable components.

This classification must consider the failure modes, effects, and criticality analysis for each specific system. Criteria and evaluation procedures should be developed which consider overall safety, mission criticality, maintenance, supportability, cost, etc. The overall approach, analysis assumptions, and candidate component lists are documented in the MECSIP master plan.

4.3.5 Material and process selection and characterization. The contractor will identify and provide rationale for the materials and manufacturing processes to be used for each component of the system. Materials selection must be accompanied by an adequate database and supporting specifications to support design methodologies. Industry process specifications should be used wherever possible to offer maximum benefit to the users to replace parts in aged systems and to establish second sources. The contractor will document the complete rationale, trade studies, and evaluation criteria used in the final selection. The rationale will consider prior operational experiences and technical data.

A plan will be developed which describes the processes and procedures to be used to characterize and select materials and processes for all elements of the system. The plan should contain equipment requirements, available database(s) for proposed materials, additional test requirements, and the rationale to be used for final material and process selections. The plan should identify methods and criteria for vendor substantiation, test requirements for material and process characterization, etc. The contractor will develop an approach to ensure minimum properties and processes as required to support the product integrity control plan (see 4.3.6). The material and process selection and characterization plan will be included as part of the MECSIP master plan.

4.3.6 Product integrity control plan. The contractor must implement special controls to ensure the required integrity characteristics of critical parts throughout production and sustainment is achieved. Candidates for specialized controls are parts classified as safety-, mission-, and durability-critical, and items which have hidden failure modes. Specialized controls may be required for materials, processes, manufacturing, quality, nondestructive inspection, corrosion prevention, etc. As a minimum, this approach and plan will include:

a. the critical parts list and selection rationale (see 4.3.4);

b. basic material properties, allowables, and process data used in the analyses and trade studies;

c. procedures to identify critical parts and special provisions on the component drawings;

d. nondestructive inspections to be performed on safety- and mission-critical components to support damage tolerance requirements;

e. special nondestructive inspection capability demonstration programs to be conducted in support of damage tolerance requirements (manufacturing and in-service capability);

f. acceptance/proof tests for individual components, as required;

g. material procurement specifications and process specifications to ensure critical parts have the required properties (e.g.; strength, fracture toughness, fatigue);

h. requirements for material/part traceability for safety- and mission-critical components which require special processing and fabrication operations; and

i. all vendor and supplier controls for these items.

Economic trade studies will be conducted to ensure the effective development and implementation of this plan. The product integrity control plan would be one of the primary data items submitted under the MECSIP and would be subject to U.S. Air Force approval.

4.3.7 Corrosion prevention and control. The contractor will define his approach to the development, evaluation, and incorporation of corrosion-resistant materials, protective treatments, finishes, etc. The selection of materials, finishes, and protection schemes must consider the service-life requirements, environmental impacts, and sustainment costs. Effects of corrosion on the mechanical properties of the materials must be established, as well as the suitability of dissimilar materials not to induce damage (galvanic effects). The plan to accomplish these tasks will be incorporated in the MECSIP master plan. Implementation of this plan will be in accordance with the product integrity control plan. (See 4.3.6.)

4.4 (Task III) Design analyses and development tests. Analyses and development tests will be performed to support the design activity and to verify that the specific performance, function, and integrity requirements have been met. These tasks should be conducted using methods which have been verified on prior programs or which will be verified during system/component development. All analytical approaches and development test plans will be described in the MECSIP master plan.

4.4.1 Design analyses. Design analyses include, but are not limited to, the elements detailed in the subparagraphs which follow.

4.4.1.1 Load definition. This analysis is used to define the magnitude and distribution of significant static, dynamic, and repeated loads which the equipment encounters when operated within the envelope established by the specific system requirements and detailed design criteria. This analysis involves identifying the internal and external operating load sources as well as inertial effects imposed by accelerations, decelerations, angular velocities, external air loads, and gyroscopic moments. Where applicable, the loads will include the effects of temperature and system installation (e.g., dynamic response and deformation of the airframe or support structure). Repeated load sources imposed by the airframe will be included, as applicable. The analysis must address flight and ground operation as well as maintenance, storage, and transportation.

4.4.1.2 Design stress/environment spectra development. This analysis will be used to develop the design stress/environment spectra for individual system elements. The design stress/environment spectra must characterize the repeated operating loads, pressures, thermal cycles, and chemicals in a format which accounts for the primary functional duty cycle and usage of the equipment. The intent is to develop a spectrum that characterizes the significant usage events which may affect primary failure modes (e.g.; fatigue, cracking, stress, corrosion, cracking, wear, etc.). This spectra will be used to assist in material selection, component sizing, and performance/life verification.

4.4.1.3 Performance and function sizing analyses. Analyses will be conducted to support sizing, configuration development, and to verify specific performance requirements.

4.4.1.4 Thermal/environmental analyses. These analyses will be conducted to determine the steady-state and transient thermal and chemical environments for individual elements of the system. Thermal and chemical environments will be used in the design, analyses, and testing (e.g.; strength, durability, damage tolerance, vibration/dynamics, etc.) of the individual components and/or systems.

4.4.1.5 Stress/strength analyses. These analyses will be conducted to determine the stresses, deformations, and margins of safety which result from the applications of design conditions, loads, and environments. These analyses are required for verification of strength.

4.4.1.6 Durability analyses. These analyses will be conducted to verify individual system components will meet the service life requirements when subjected to the operational usage and environments. Analyses will be conducted early in the acquisition phase to support design concept development, material selection, and weight/cost/performance trade studies. Early analyses will enable identification of failure modes and sensitive areas, particularly those with potential for early fatigue, wear, environmental degradation, or thermal distress. Allowable limits for critical failure modes, cracking, wear, and environmental degradation must be defined as part of these analyses. Early analysis should be emphasized to minimize occurrences of deficiencies during subsequent development and functional testing. Material and process data required to support analytical methods will be generated in accordance with 4.4.2.1.

Durability analyses will be used to predict the operational life with and without scheduled maintenance. The analyses must consider material variability, initial manufacturing quality, and functional limits for each critical failure mode. Analyses must show that adverse cracking, wear, delamination, or other damage formation will not occur within the required operational service period when subjected to the required usage and environments. Components should be designed and analyzed to twice the required service life using nominal properties, tolerances, etc., to account for variations in material properties, processes, manufacturing, etc. Individual component analytical results will be used to prove the available economic life of the total system is at least equal to the required operational service life specified in the contractual documents.

4.4.1.7 Damage tolerance analyses. Damage tolerance analyses must be conducted early in the acquisition phase to support design concept development, material selection, and weight/cost/ performance trade studies. Early analyses will enable identification and cost-effective correction of structurally-sensitive areas which do not meet specific flaw or crack tolerance, redundancy, leak before break, or other damage tolerance characteristics. Material property data required to support analysis will be developed in accordance with 4.4.2.1. Analytical methods must be verified with test data. Damage tolerance analyses must predict flaw tolerance margin, fail-safe operational life (including leak before break) and other features incorporated to satisfy damage tolerance criteria. Components should be designed and analyzed to twice the required service life using nominal properties, tolerances, etc., to account for variations in material properties, processes, manufacturing, etc. The damage tolerance analyses apply to safety-critical and mission-critical components only.

4.4.1.8 Vibration/dynamics/acoustic analyses. Dynamics analyses must be conducted to establish component vibration and acoustic mode shapes and frequencies. An analytical dynamic model of the system and/or critical components must be developed to identify critical system modes, potential forcing functions, and resonance conditions.

4.4.2 Development tests. The amount and type of tests required to support the design and development will vary. These will include, but not be limited to, the tests described in the following subparagraphs.

4.4.2.1 Material characterization tests. Material characterization data such as strength, fatigue, fracture toughness, crack growth rate, corrosion resistance, wear, and thermal stability are required to support the design and to meet specific integrity-related requirements. When the data is not available, material properties must be established by test. Test specimens must be fabricated to include critical manufacturing processes (e.g.; forming, joining, assembly techniques). The test plan will identify the vendor material characterization test requirements necessary to ensure minimum required properties in finished parts throughout production.

Materials property data must be statistically significant. All materials must be procured to existing materials and process specifications. Any changes to the materials and process specifications may require retest. Section thickness, thermal treatments, and manufacturing methods must be the same as the production hardware.

Existing data obtained from literature sources or previous program experiences may be used. However, for critical component application (see 4.3.4), these properties must be verified using specimens fabricated from actual parts, as required.

Materials for critical systems and components (see 4.3.4) should be characterized to include the full range of design and operating conditions. Cyclic loading and time-dependent properties should reflect the environmental and design usage defined in the contractual documents or as modified in this handbook.

4.4.2.2 Design development tests. Development tests must be conducted to support component and system sizing, material selection, durability assessment, design concept trades, and analysis verification, and to obtain an early indication of compliance with specific performance requirements. Examples of design development tests are tests of coupons, small elements, joints, fittings and sealing concepts, controls, linkages, operating mechanisms, and major components—such as pumps, reservoirs, and actuators.

The scope of development tests will be established in the MECSIP master plan and will include rationale for the tests, description of the test articles, test duration, and criteria for interpretation of test results.

4.5 (Task IV) Component development and systems functional tests. These tests are intended to verify the system integrity performance. Tests may be conducted on systems or individual components, in simulated system installation environments, or during flight and ground testing. All testing will be planned, scheduled, and conducted in accordance with the overall system test plan and specific requirements. Tests will include, but not be limited to, those described in the following subparagraphs.

4.5.1 Functional tests. Full-scale component, system ground (e.g.; iron bird, simulator), and/or flight tests will be required to verify specific functional performance requirements. Examples of functional testing include fluid flow performance, leakage, brake performance, and flight control performance. When practical, these tests should be used to evaluate and verify equipment integrity.

4.5.2 Strength testing. Testing of components, assemblies, and/or systems must be performed to verify strength requirements. Thermal and other environmental effects must be simulated along with load applications when these conditions impose significant effects on the component strength. Test results will be used to evaluate design margins and growth capability.

4.5.3 Durability testing. A test program will be conducted to substantiate the overall durability of system components. Durability testing consists of component, assembly, and/or full system tests which simulate repeated loads and environmental conditions that represent design usage and design service life criteria.

Tests, particularly for expensive and long lead development items, should be scheduled early to allow for identification and correction of critical areas and failure modes (e.g.; cracking, deterioration, leakage). All durability verification testing should be successfully completed prior to delivery of the first production system. Testing milestones will be established as part of the overall system test planning.

The results of durability testing will be the basis for any design modifications, special inspections, and maintenance actions for critical components and installed systems.

Test duration requirements will vary depending on the specific application. Components should be required to demonstrate two design service lives to impart confidence that the component will achieve one lifetime in service. Test articles must be selected which represent the production configurations. Test loadings and environments must represent the significant elements of the design service usage spectrum. Truncation and simplification of the repeated loads and environments must be substantiated by analysis and/or test to verify equivalency to the design usage spectrum.

All test results will be evaluated and compared against the original predictions for wear and life. When damage is worse than predicted, the affected parts will be analyzed and appropriate corrective actions taken.

Safety- and mission-critical parts are replaced during service at one-half the demonstrated life.

4.5.4 Vibration/dynamics/acoustics tests. These tests are conducted to verify the vibration, dynamics, and acoustics response characteristics of the installed system and/or critical system components.

4.5.5 Damage tolerance tests. These tests are conducted to verify the damage tolerance characteristics of safety-critical and mission-critical components. These tests are used to establish damage tolerance margins, crack growth rates, critical crack lengths, residual strength, fail safety, leak before break, or other characteristics defined by the specific damage tolerance criteria. No testing will be necessary for relatively simple geometries and well-characterized materials, if there is adequate confidence in the accuracy of the analysis. Coupon, element, or component-level testing will be necessary for all other cases. The combination of analysis and test should demonstrate two design service lives to impart confidence that the component will achieve one lifetime of service. An in-service inspection period will be established at one-half the validated design service life. Components which satisfy damage tolerance through high durability margins must be tested to the appropriate number of equivalent lives (typically four or more) necessary to gain high confidence that the component will achieve one lifetime of service.

4.5.6 Thermal and environment survey. Temperatures, loads, and other environmental factors must be measured during the component development and system functional and flight tests. These values must be compared against predicted values to verify design criteria. Data obtained from these surveys will be used to adjust operational limits and maintenance actions as determined from analysis and tests. The information will also be retained as "lessons learned" to assist in the development of criteria for future applications. The plan and approach for conducting this survey will be included with the MECSIP master plan.

4.5.7 Maintainability/reparability demonstrations. The contractor will conduct a program to develop and demonstrate maintenance procedures. The demonstrations may be conducted in conjunction with development and/or full system tests. Authorized repairs and repair limits must be in accordance with the documented maintenance and logistics requirements. Testing will be conducted as required to validate the integrity of authorized repairs.

4.5.8 Evaluation and interpretation of test results. The contractor will describe the procedures to evaluate, interpret, and incorporate all test findings (e.g.; cause, corrective actions, program implications, maintenance projections, and costs). This evaluation will define corrective actions required to demonstrate design requirements are met. Each problem (cracking, yielding, wear, leakage, etc.) that occurs during testing must be evaluated. Inspections, disassembly, and destructive tear-down evaluations will be conducted.

4.5.9 Integrated test plan. All test requirements identified for the specific system equipment must be defined, scoped, and scheduled in an integrated test package. This includes tests associated with development and full qualification, as well as any subsequently-scheduled growth or margin testing. Vendor and supplier tests will be included in this plan. The contractor will seek the most economical balance of requirements, verification, and test articles when integrated tests are compiled. The integrated test plan will be incorporated into the overall system test plan.

4.5.10 Final integrity analysis. The design analyses (Task III) for safety-, mission-, and durability-critical components must be updated to account for significant differences between analyses, tests, and the thermal/environmental/load survey. These updated analyses will provide data on operational limits to be used in maintenance, inspection, and repair times for critical components. These analyses and evaluation of test results will be utilized to develop maintenance and inspection planning. Analyses to be updated will include, but not be limited to, the following:

a. durability;

b. strength;

c. damage tolerance;

d. loads; and

e. stress—environmental and thermal.

These final analyses will be developed following completion of the design/development test and analysis phase and will be submitted in accordance with specific program requirements. This plan will require U.S. Air Force approval.

4.5.11 Maintenance planning and task development. Required maintenance actions (e.g.; inspection, repair, or replacement) will be developed to ensure the integrity and operability of the system for the required operational service life. Initial maintenance action requirements and times will be based on updated analyses and test data in accordance with 4.5.10. These actions and times will be modified, as appropriate, according to information and experience from in-service operation.

The required maintenance action times must be based on duty cycles and usage in accordance with the specific design criteria and system requirements. The initial maintenance plan will be developed following completion of the design/development test and analysis phase and will be submitted in accordance with specific program requirements. This plan will require U.S. Air Force approval.

4.6 (Task V) Force management. Force management includes those actions necessary to ensure that the safety, reliability, and durability requirements established in Tasks I through IV are met and maintained throughout the entire life of the weapon system. The MECSIP manager has overall responsibility to manage the health of the systems, regardless of the overhauling depot. He will be part of any management process that impacts the safety, suitability, effectiveness, reliability, and durability of a system or its components. The MECSIP manager will: 1) update and maintain the MECSIP master plan as necessary to reflect the needs associated with sustainment, 2) establish and monitor a component tracking program, 3) establish preventative maintenance actions, 4) establish repair/overhaul procedures, and 5) establish inspection criteria.

4.6.1 Component tracking/monitoring program. In-service failure data must be constantly monitored. Three years of data must typically be collected before premature failures can be effectively identified. After three years, the MECSIP manager’s tracking program should automatically notify him if the Mean-Time-Between-Failure (MTBF) rate changes more than twenty-percent over an 18-month time period. The MECSIP manager should review the situation and determine if further engineering analysis is required. If an analysis is required and it exceeds the facilities or skills of the assigned personnel, contractual assistance may be used. The MECSIP manager will fund all requests for analysis generated by his office. The intent of the analysis is to increase the Component Time to Failure (CTTF) (the point at which a component experiences an inherent failure that requires its removal from the air vehicle) to an acceptable level. The tracking program should provide a monthly failure listing for each system to alert the MECSIP manager of potential failures. The MECSIP manager will establish a priority schedule for each system based on 4.3.4 (critical parts analysis and classification) and on current data. The MECSIP manager should rely on the Material Deficiency Report/Quality Deficiency Report system for alerts prior to the three years of collected data.

4.6.1.1 Operational usage data. Weapon systems must have adequate instrumentation to monitor air vehicle usage, thus permitting continual updates to the CTTF predictions. The instrumentation should monitor parameters such as landing gear and weapon bay door cycles, flight control actuation, electrical power distribution, and temperature differentials. The tracking program must be able to accept and utilize this data.

4.6.2 Preventative maintenance actions. Preventative maintenance is designed to preclude component failure. Based upon the maintenance-free operating period established in Tasks III–IV, as well as available field data, a time-change or other preventative maintenance action can be planned during scheduled downtimes to prevent loss of scheduled missions and to ensure a high level of safety. A unit's mission profile may have a significant effect on the CTTF. For example, bases which perform pilot training will generally have an increase in landing gear and flight control malfunctions, thereby reducing their CTTF. The trade studies performed in Tasks I through III will help the MECSIP manager select a tracking program that will best establish the CTTF.

4.6.2.1 Flight-hour time change. A flight-hour time change should be considered for problematic components which are durability critical or have a hidden failure mode, and have an established, reliable CTTF. Components should be replaced at or prior to the CTTF in conjunction with regularly-scheduled maintenance (Home Station Checks, Major Isochronal Inspections, Phase or Periodic Depot Maintenance). Prime candidates for time change are mechanical assemblies such as actuators, jackscrews, valves, pumps, tension regulators, and landing gear. Benefits derived from the time changes are numerous. However, most electronic components typically do not benefit from the time-change actions. Safety- and mission-critical components have their own unique set of requirements, which are defined in 4.6.4.1.

4.6.2.2 Calendar time change. Calendar time change components are durability non-critical components whose failure would have a minor impact on the system but would still require maintenance for continued flight operations. These components, when identified, can be repaired or replaced during scheduled maintenance such as Isochronal Inspections, and Phase or Periodic Depot Maintenance. Similar to time change, these components are repaired or replaced on a calendar-inspection basis, not a flight-hour basis.

4.6.2.3 On-equipment repairs. It may be more advantageous during the operational service life of a component to make minor repairs or replace an attaching Line Replacement Unit (LRU) than to replace the component. Repairs may include replacement of the rubber seals, rod ends, bearings, etc. These repairs should be identified in Task IV, and technical data relative to the repairs should be made available for reference.

4.6.2.4 Lubrication/cleaning and adjustments. The system may require periodic maintenance if it is to perform correctly. For example, the MECSIP manager must ensure that proper wash and lube are scheduled to prevent corrosion, and that any necessary adjustments (e.g., to flight controls or landing gear) are made during the scheduled maintenance. Wartime conditions do not preclude performance of these scheduled maintenance tasks.

4.6.2.5 Overhaul of systems. As systems age, wear in individual components may lead to unreliable and eventually failed systems. The tendency is to replace the link in the system that has the most wear and to return the air vehicle to service. This provides an inexpensive and rapid fix; however, this type of "piece-meal" repair lasts only until the next link fails. Once a unit or system reaches this condition, the refurbishment of the entire unit or system to "like-new" condition becomes more economical than the continued removal of an air vehicle from service to accomplish what are essentially temporary repairs. While entire system replacement may seem expensive, the cost must be compared to the time lost for air vehicle downtime. Items such as torque tubes, rod end bearings, quadrants, and pulleys are prime candidates for this type of maintenance. These items require little attention from the MECSIP manager in the beginning but must be part of the matrix as the air vehicle ages.

As systems are initially received for overhaul (first scheduled depot maintenance), one or more lead-the-fleet (high time) units should be selected for a complete disassembly and inspection. The purpose is to compare the degradation against that predicted. If degradation is found in areas not expected, or the degradation is more severe than predicted, appropriate actions must be taken to prevent in-service failure and/or unscheduled maintenance.

4.6.2.6 Replacement of original equipment. Many components are designed with a service life that exceeds that of the air vehicle. As a result, little or no preventative maintenance is required. Examples include actuating cylinders, electrical connectors, and bleed ducts. Wear-out mechanisms for other components become well defined as the system ages. Identification and correction of these components are becoming increasingly important as more aircraft continue to remain in service past their original design lives. In some cases, upgrades to the same equipment can easily be provided with advanced materials which will increase the component's life.

4.6.2.7 Replacement of obsolete equipment. Some older aircraft may use antiquated equipment. Newer technology may enable replacement with improved reliability. An example of this would be the new fly-by-wire versus the mechanical linkage for flight controls. It may be cheaper and more feasible to replace these systems with the newer technology. The MECSIP manager must be ready to make this type of decision based on collected data and trade studies.

4.6.2.8 Environmental regulations. Environmental regulations must be considered in the selection of materials. Changes in the environmental laws may also drive replacement programs. Any replacement material must be analyzed and/or tested to ensure it meets the original design and service life requirements. For uncharacterized materials, characterization testing must be conducted in accordance with 4.4.2.1. Asbestos seals and clamps are examples of items which must be replaced. Depleted uranium flight control counter-weights must be refurbished to prevent hazardous materials contamination. Paint, plating, cleaning, and corrosion control systems must be updated. The MECSIP manager must receive periodic briefings on environmental changes to ensure safe maintenance and operational procedures.

4.6.3 Monitoring of repairs/overhauls. If a component fails, it can be either thrown away or returned for overhaul, based upon the results of a life cycle cost analysis. To "overhaul" a component is to return it to a "like-new" condition. To "repair" a component is simply to make it serviceable. The MECSIP manager must ensure serviceable items returned to base supply have been "overhauled" or meet the intent of "overhaul." Unfortunately, it is difficult or impossible to restore a used part to a "like-new" condition. Parts which were not replaced during overhaul have some percentage of their original life consumed. Plating landing gear to build-up areas where corrosion was removed can affect the overall properties of the unit. It is the MECSIP engineer's responsibility to ensure that any degradation in overall condition is acknowledged and accounted for in the overhaul process.

4.6.3.1 Field/base-level maintenance. The MECSIP manager must either ensure that each base has the proper “overhaul” capabilities (i.e.; test equipment, technical orders, plating equipment, etc.) for a specific component or restrict that base from performing the overhaul. This can be best accomplished by ensuring the Aircraft Scheduled Inspection and Maintenance Requirement technical orders are current and enforced. If a component is repaired at the base level, then consideration should be given to a requirement that the component be periodically returned to the depot (e.g., after the third base-level overhaul) to ensure the reliability of the component continues to be met. The MECSIP manager can recommend no base-level repairs and establish regional repair facilities. The cost of training technicians and test equipment may prohibit base-level repairs and may lead to regional or “Queen Bee” facilities. The MECSIP manager must have a list of contacts for each base and be aware of their capabilities. If an overhaul is performed, the master maintenance action log originated by the owning depot must be updated.

4.6.3.2 Depot-level maintenance. The depot strongly influences the continued reliability of the components and systems. One-of-a-kind test equipment, special tools, and chemical plating are combined with special training to ensure components are returned to a “like-new” condition. Each component that enters the depot should have a Master Maintenance Action Log attached to the component or recorded against its serial number in a computer database. All maintenance actions which occur on the component should be annotated in the log to assist in maintaining the reliability of the component. This log must be kept for the life of the component. Components which enter the depot will be overhauled and have the parts replaced, as indicated by the maintainability/reparability demonstrations contained in 4.5.7. If a part shortage occurs and a part listed for replacement during overhaul is not available, Air Logistics Center (ALC)-engineering may authorize the re-use of certain parts for one overhaul only. The maintenance log will be annotated to reflect this, and the part must be replaced during the next overhaul. If the reliability rate drops after numerous overhauls, the MECSIP manager may elect to restrict the number of overhauls a component may undergo. The MECSIP manager, in concert with ALC engineering, is responsible for ensuring component reliability.

4.6.4 Inspection criteria. The inspection criteria are established during Tasks III and IV. The list is constantly updated using data collected from operational units, personal contacts, base or depot inspections, and maintenance deficiency reports. The inspection requirements should establish the equipment to be inspected, its inspection schedule, and its inspection criteria. The inspection process is a key to ensuring the MECSIP process is effective. Computer programs must link all bases which perform inspections, compile and list common deficiencies, and identify potential problem areas. Systems are generally modified based on inspection reports and maintenance man-hours annotated in the reports. The MECSIP manager will meet yearly with all major inspection chiefs to discuss improvements and new inspection criteria. The MECSIP manager will establish an electronic bulletin board to assist in the daily communication with maintenance personnel and will establish a list of contacts for each base.

4.6.4.1 Damage-tolerance-critical components. Safety- and mission-critical components are categorized as damage-tolerance critical since failures cannot be tolerated. The components must be inspected and/or replaced at some portion of their demonstrated service life to ensure failure-free operation. This is to account for flaws that may exist as the result of the material, manufacturing, and maintenance operations. The components are typically inspected at one-half the demonstrated life to assess the size of any existing flaws and to determine their impact on remaining component life. Inspections will not be required over one lifetime of service if the components are designed and validated to the appropriate number of multiple service lives (e.g., two lifetimes). The MECSIP manager must ascertain the demonstrated life for each damage-tolerance-critical component and establish any necessary inspection period. A replacement interval must be established for components which cannot be inspected.

5. NOTES

5.1 Intended use. Mechanical equipment and subsystems which provide power, control, and other contributory functions are essential elements of weapon systems. This handbook is intended to be used to establish programmatic tasks for the development, acquisition, modification, operation, and sustainment of the mechanical elements of airborne, support, and training systems.

5.2 Data requirements. When this handbook is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirement List (CDRL), the data requirements identified below may be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL. When the DoD Federal Acquisition Regulation Supplement exempts the requirement for a DD Form 1423, the data specified below may be deliverable by the contractor in accordance with the contract or purchase order requirements. The deliverable data may include:

Paragraph	Data Requirements Title
4.3.1	MECSIP master plan
4.3.6	Product integrity control plan
4.5.10	Final integrity analysis
4.5.11	Maintenance planning and task development.

The current issue of the DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure only current and approved DIDs are cited on the DD Form 1423.

5.3 Subject term (key word) listing.

Equipment, Air Vehicle

Equipment, Ground Vehicle

Maintainability

MECSIP

Reliability

Systems, Mechanical

5.4 Responsible engineering office. The office responsible for development and technical maintenance of this handbook is ASC/ENFA, 2530 LOOP ROAD WEST, WRIGHT-PATTERSON AFB OH 45433-7101; DSN 785-9552, Commercial (937) 255-9552. Any requests for information that relates to government contracts must be obtained through Contracting Offices.

5.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:
Army – AV
Air Force – 11

Preparing activity:
Air Force – 11

(Project SESS-0003)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to preparing activity.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** MIL-HDBK-1798A	**2. DOCUMENT DATE (YYYYMMDD)** 20010924

3. DOCUMENT TITLE
MECHANICAL EQUIPMENT AND SUBSYSTEMS INTEGRITY PROGRAM

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON *(if applicable)*	**7.DATE SUBMITTED** (YYYYMMDD)

8. PREPARING ACTIVITY

a. NAME Air Force Code 11	b. TELEPHONE *Include Area Code)* (1) Commercial (937) 255-6295 (2) AUTOVON 785-6295
c. ADDRESS *(Include Zip Code)* ASC/ENOI 2530 LOOP ROAD WEST WRIGHT-PATTERSON AFB OH 45433-7101	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman road, Suite 2533, Ft. Belvoir, VA 22060-2533 Telephone (703) 767-6888 AUTOVON 427-6888